# Three Phosphorus TMDLs for the Atlantic Water Region

## Shark River and Metedeconk River North Branch Watersheds

## August 8, 2005

**New Jersey Department of Environmental Protection**
**Division of Watershed Management**
**Bureau of Environmental Analysis and Restoration**

***Ariane Giudicelli, Karen Dorris, Todd Kratzer, Kim Cenno***

# Overview of Presentation

- What is a TMDL
- Flow Integrated Reduction Methodology
- TMDL Calculations for Impaired Segments
- TMDL Implementation Measures
- Summary

# What are TMDLs?

- Total Maximum Daily Loads (TMDLs) represent the assimilative or load capacity of the receiving water, taking into consideration:
  - point sources of pollutants (wasteload)
  - nonpoint sources of pollutants (load)
  - natural background

# 2004 Integrated List

305(b) Report

**SUBLIST 1 & 2**: FULL ATTAINMENT

LIMITED ATTAINMENT DATA

**SUBLIST 3:** INSUFFICIENT DATA TO ASSESS

**SUBLIST 4:** IMPAIRED BUT:

TMDL Completed

IMPAIRMENT BY POLLUTION NOT POLLUTANT

OTHER ENFORCEABLE MEASURES WILL ADDRESS

**SUBLIST 5:** NON-ATTAINMENT } 303(d) List

# Establish & Implement TMDLs

- Establish TMDL in accordance with MOA schedule with EPA:
  - Propose TMDL as an amendment to water quality management plans (WQMPs)
  - Establish TMDL - submit to EPA for formal approval
  - Adopt TMDL as amendment to WQMP
- Implementation of Control Actions:
  - Issue water quality-based permits
  - Additional Measures per Phase 2 Stormwater Permits
  - Implement nonpoint source controls through funding from NJDEP as it is available (319H & CBT)

# How are **TMDLs** expressed?

Amount of pollutants that a waterbody can assimilate without violating surface water quality standards or other target

$$TMDL = \sum WLA + \sum LA + MOS$$

**Where:**

**WLA is the wasteload allocation**

**LA is the load allocation and**

**MOS is the margin of safety**

# Margin of Safety (MOS)

- A required component of the TMDL that accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.79(c))
- The MOS shall be expressed either as an internal modeling factor and/or as an explicit, separate factor (N.J.A.C. 7:15- 7.7(a))

# Components of TMDL Document

- Source assessment
  - characterization and quantification as necessary
  - identify point, nonpoint and background sources
- Water quality analysis
  - link pollutant sources & water quality: model
  - consider seasonal variation / critical conditions
- TMDL calculations
  - loading capacity
  - margin of safety
  - load and wasteload allocations
- Follow-up monitoring
- Implementation
- Public participation

# Target for TMDL: SWQS for Phosphorus (mg/L)

## Numerical Criteria

- i. **Lakes**: TP not to exceed **0.05** in any lake, pond, reservoir, or in a tributary at the point where it enters such bodies of water, except where site-specific criteria are developed (N.J.A.C. 7:9B-1.5(g)3)

- ii. **Streams**: TP not to exceed **0.1** in any stream, unless it can be demonstrated that TP is not a limiting nutrient and will not otherwise render the waters unsuitable for the designated uses.

# SWQS for Phosphorus (mg/L), continued

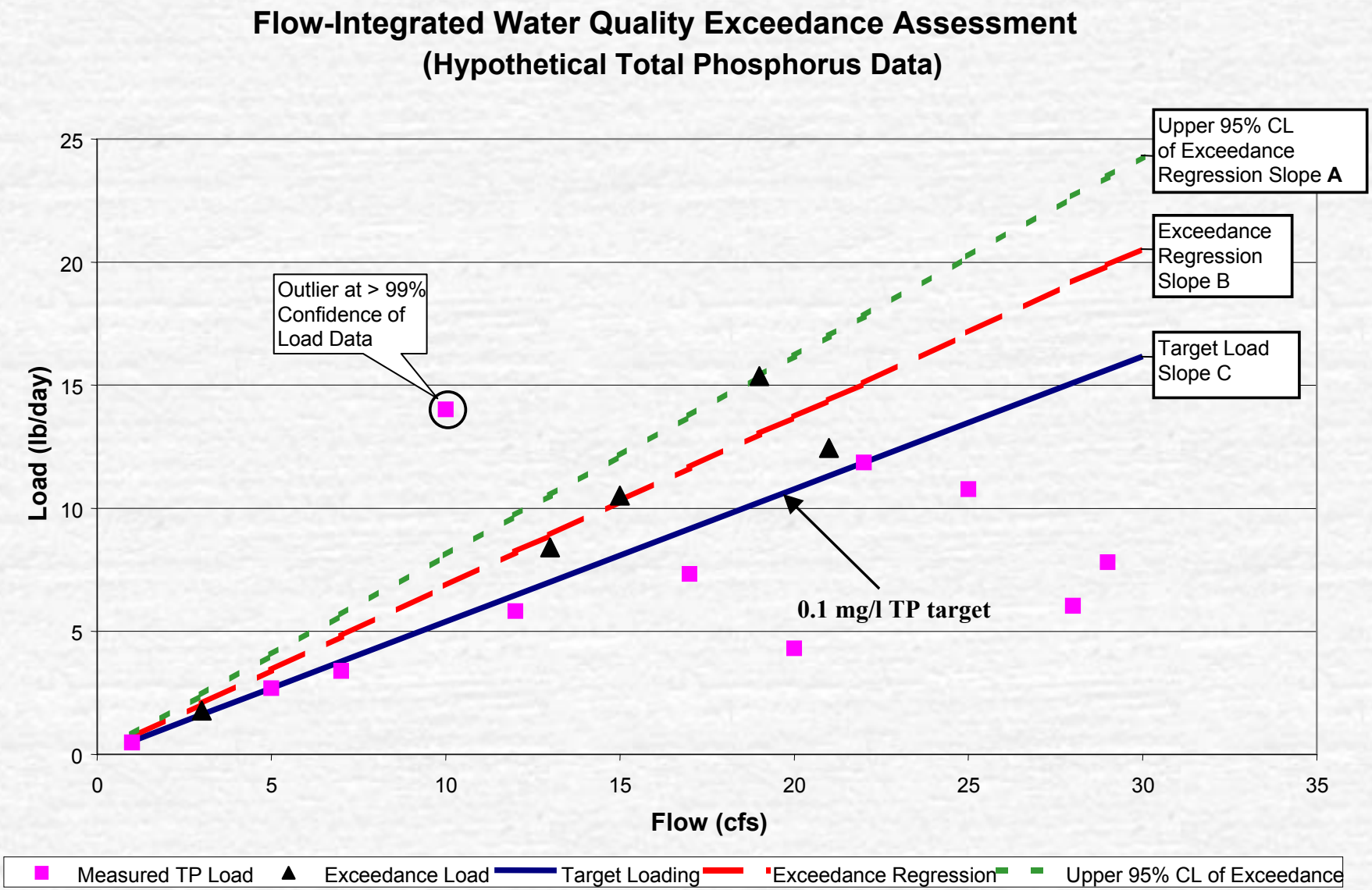
**Narrative Criteria--Nutrient policies are as follows:**

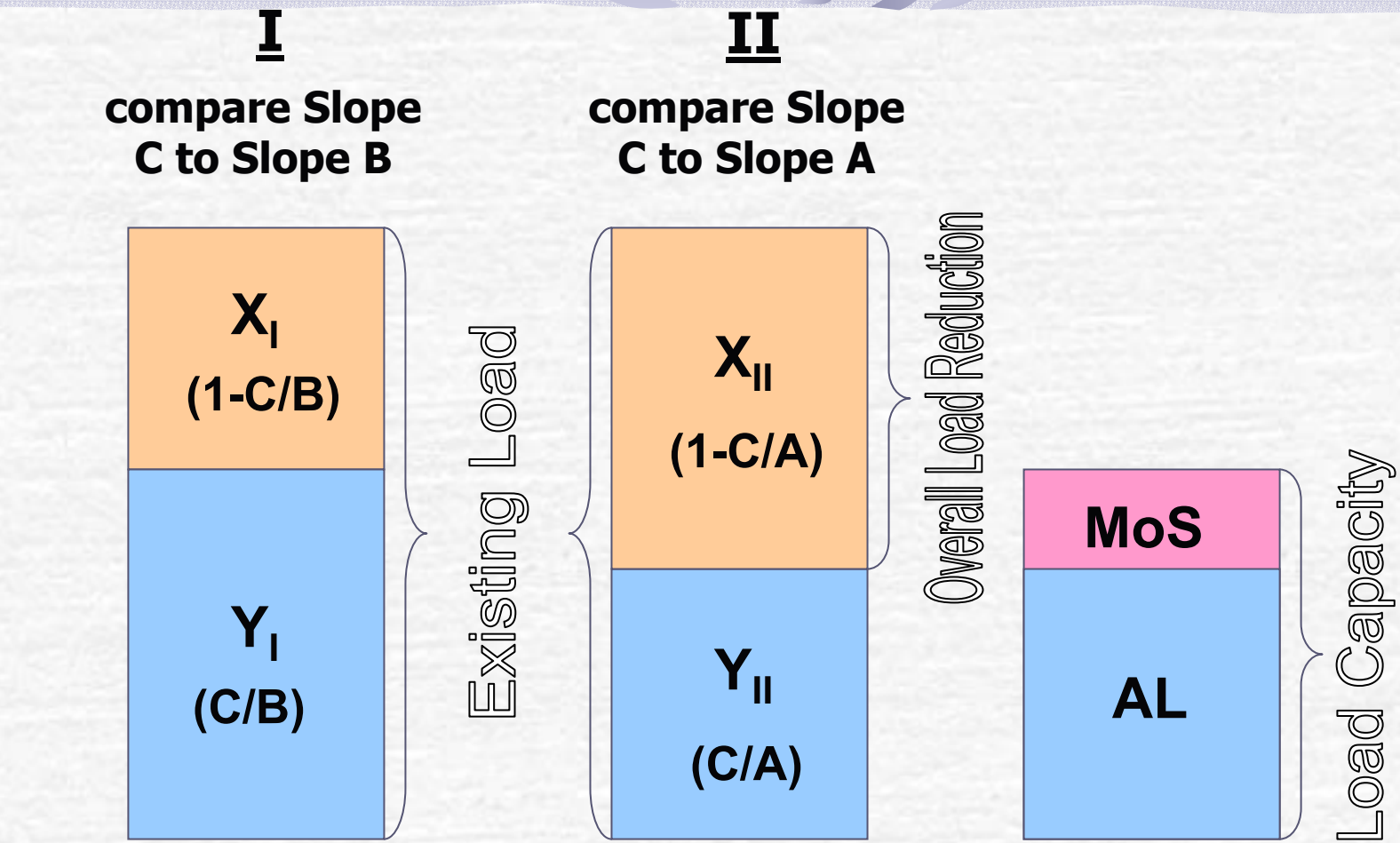
- Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, abnormal diurnal fluctuations in dissolved oxygen or pH, changes to the composition of aquatic ecosystems, or otherwise render the waters unsuitable for the designated uses.

# TMDL Model Used:Flow-Integrated Reduction of Exceedances (FIRE)

- Method must be selected to relate water quality to pollutant loading
- FIRE uses site-specific water quality concentration and flow data to determine the relationship between flow and load. The required reduction was calculated by comparing the site-specific relationship to the target relationship, which corresponds to attainment of the New Jersey Surface Water Standards.

# Illustrative Example of FIRE






**X= load to be reduced; Y= existing load – X**

**Load Capacity = $Y_I$; AL( Allocable Loading) = $Y_{II}$; MOS (Margin of Safety) = $Y_I$-$Y_{II}$**

# Load Capacity

- The Load Capacity of the waterbody is calculated by comparing the Exceedance Regression line to the Target Loading line, including a Margin Of Safety (MOS)
- MOS is derived from the difference between the slopes of the Upper 95 percent confidence limit of the Exceedance Regression and the Exceedance Regression line and becomes an unallocated portion of the Load Capacity

# Load Reduction

- The Overall Load Reduction required is calculated based on the difference between the slopes of the Upper 95 percent confidence limit of the Exceedance Regression and the Target Loading lines.

# Allocating Load Reduction

- Existing load is calculated by applying loading (or export) coefficients, which represent annual average loads from various land uses, to the areal extent of each land use in the drainage area, determined using GIS
- WLAs and LAs are then derived from the allocable load, with LA reductions taken only from land uses where reductions are feasible
- No reduction is taken from forest, wetland, water and barren land uses; these load contributions remain unchanged between existing and future scenarios

# UAL Methodology

Pollutant Export Coefficients obtained from literature sources are applied to land use patterns:

- Land Use determined by NJDEP's 1995/97 GIS Coverage.
- Phosphorus export coefficients selected for NJ from an extensive database to develop table on next slide.

# Phosphorus export coefficients (Unit Areal Loads)

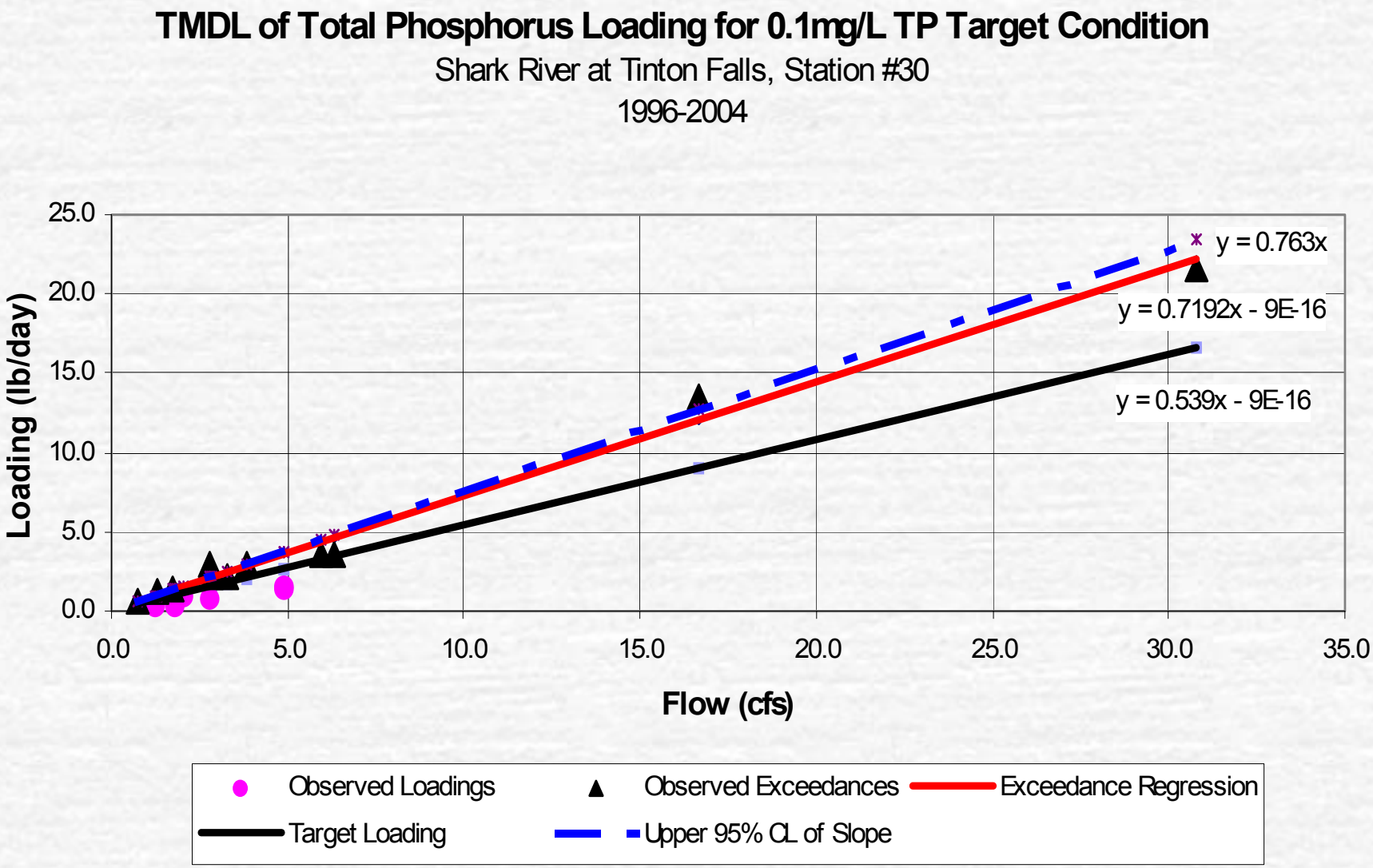
| land use / land cover | LU/LC codes | UAL (kg TP/ha/yr) |
|---|---|---|
| Mixed Density Residential | 1100 | 1.2 |
| medium / high density residential | 1110, 1120, 1150 | 1.6 |
| low density / rural residential | 1130, 1140 | 0.7 |
| Commercial | 1200 | 2.0 |
| Industrial | 1300, 1500 | 1.7 |
| mixed urban / other urban | other urban codes | 1.0 |
| Agricultural | 2000 | 1.5 |
| forest, wetland, water | 1750, 1850, 2140, 2150, 4000, 5000, 6000, 7430, 8000 | 0.1 |
| barren land | 7000 | 0.5 |

Units : 1 hectare (ha) = 2.47 acres
1 kilogram (kg) = 2.2 pounds (lbs)
1 kg/ha/yr = 0.89 lbs/acre/yr

# Impaired Segments

- *Shark River Brook at Shark River Station Rd. in Tinton Falls*
- *Shark River near Neptune*
- *Metedeconk River North Branch at Jackson Mills in Freehold*

# Example of FIRE Application



# TMDL Calculations

- **Load Capacity (Target Load)**
  = (0.5390 ÷ 0.7192) x 100 = % of existing loadings
- **Total Overall Loading Reduction**
  = (1 – (0.5390 ÷ 0.7630)) x 100
  = % of existing loadings
- **Margin of Safety**
  = (1 – (0.7192 ÷ 0.7630)) x 100
  = % of Load Capacity
- **Percent Reduction of Adjustable Land-Use Loads**
  = [1 - (Load Capacity – MOS – Non-Adjustable Land-Use Loads) ÷ Total Existing Loads – Non-Adjustable Land-Use Loads)] x 100
  = % of existing loadings

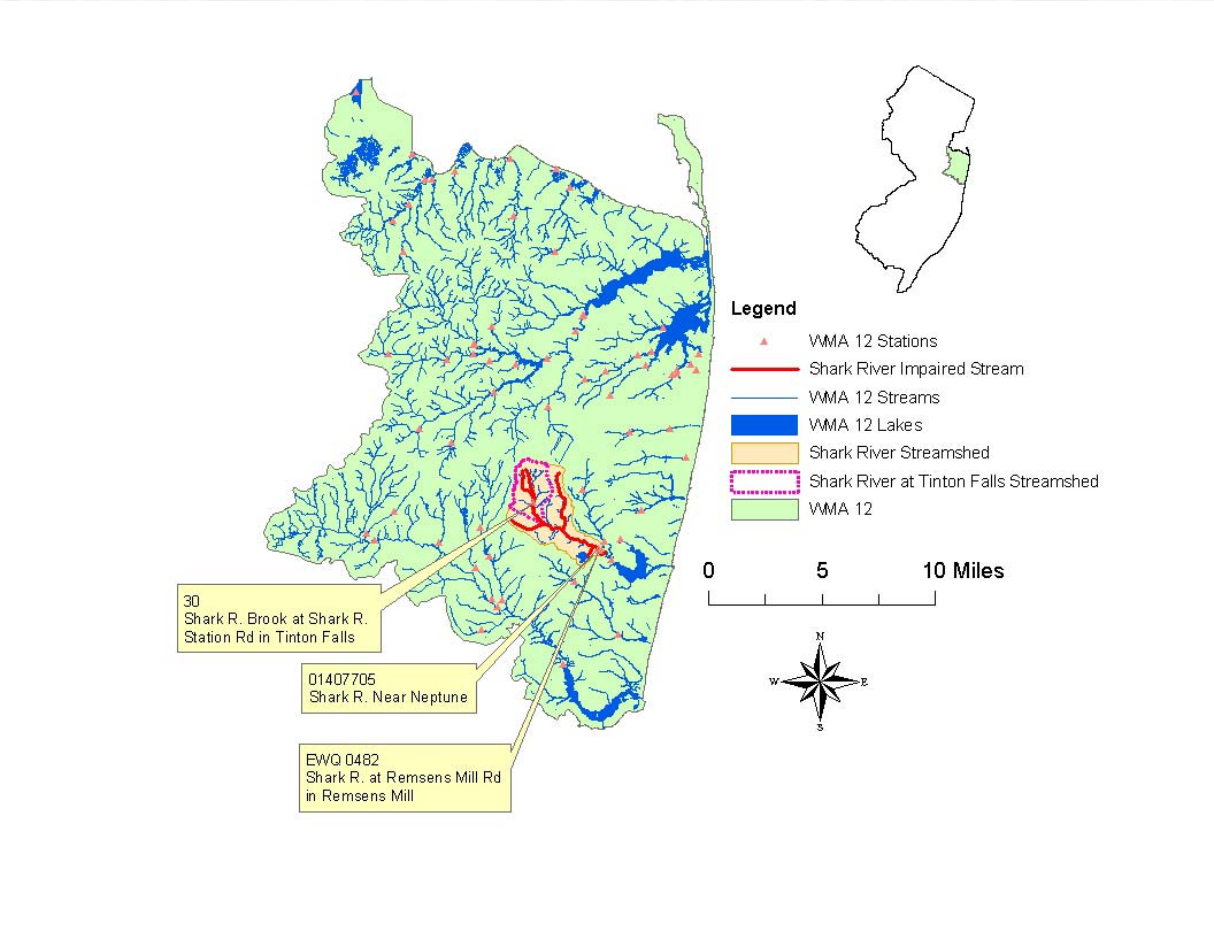
# Summary of FIRE Application

| TMDL | Shark River in Tinton Falls | Shark River near Neptune | Metedeconk River NB at Jackson Mills |
|---|---|---|---|
| **Derived from FIRE Method:** | | | |
| Slope A | 0.7630 | 1.3134 | 1.4123 |
| Slope B | 0.7192 | 0.8632 | 1.0741 |
| Slope C (SWQS at 0.1 mg/L) | | 0.5390 | |
| **Derived from Export Coefficients:** (kg/year) | | | |
| Total Existing Loading | 340.9 | 743.5 | 714.3 |
| Non-Adjustable Loading | 107.4 | 148.3 | 193.9 |
| Loading capacity (TP not to exceed 0.1 mg/L) | 255.5 | 464.3 | 358.4 |
| Margin of Safety (Percent of Loading Capacity) | 14.7 | 159.2 | 85.8 |
| Overall Load Reduction Required (including MOS) | 29.4% | 59.0% | 61.8% |
| Adjustable Load Reduction Required | 42.8% | 73.7% | 84.9% |

# Summary of Data

- Shark River Brook at Shark River Station Rd. in Tinton Falls; 11 of 18 results (61%)
- Shark River at Neptune; 4 of 35 results (12%)
- Metedeconk River North Branch at Jackson Mills in Freehold; 8 of 17 results (47%)
- It could not be determined whether or not phosphorus is the limiting nutrient
- TMDL is Required

# Map of WMA 12


Legend
WMA 12 Stations
Shark River Impaired Stream
WMA 12 Streams
WMA 12 Lakes
Shark River Streamshed
Shark River at Tinton Falls Streamshed
WMA 12
0
5
10 Miles
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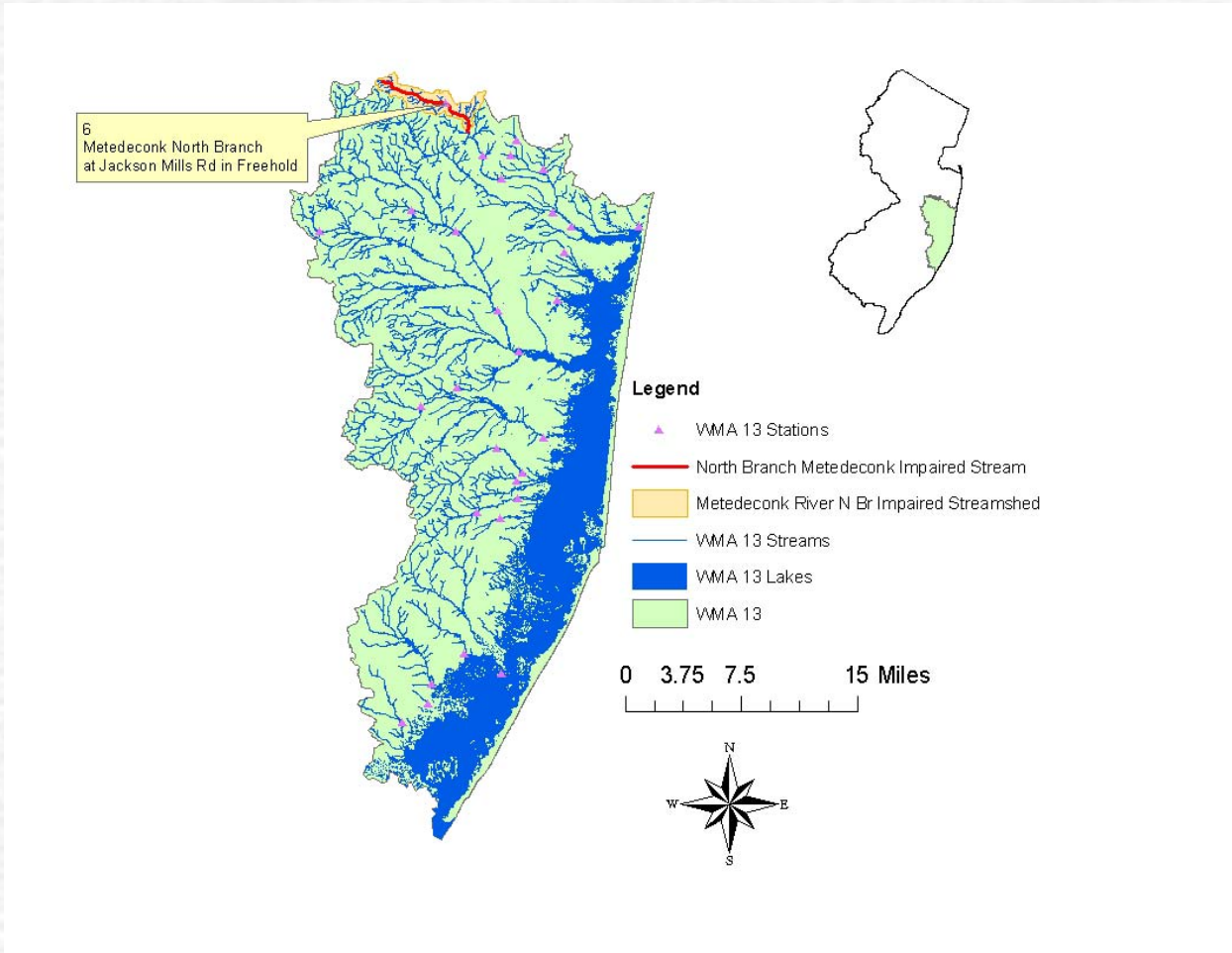
Shark R. Brook at Shark R.
Station Rd in Tinton Falls
01407705
Shark R. Near Neptune
EWQ 0482
Shark R. at Remsens Mill Rd
in Remsens Mill

# Map of WMA 13


6
Metedeconk North Branch
at Jackson Mills Rd in Freehold
Legend
WMA 13 Stations
North Branch Metedeconk Impaired Stream
Metedeconk River N Br Impaired Streamshed
WMA 13 Streams
WMA 13 Lakes
WMA 13
0 3.75 7.5 15 Miles
N
W
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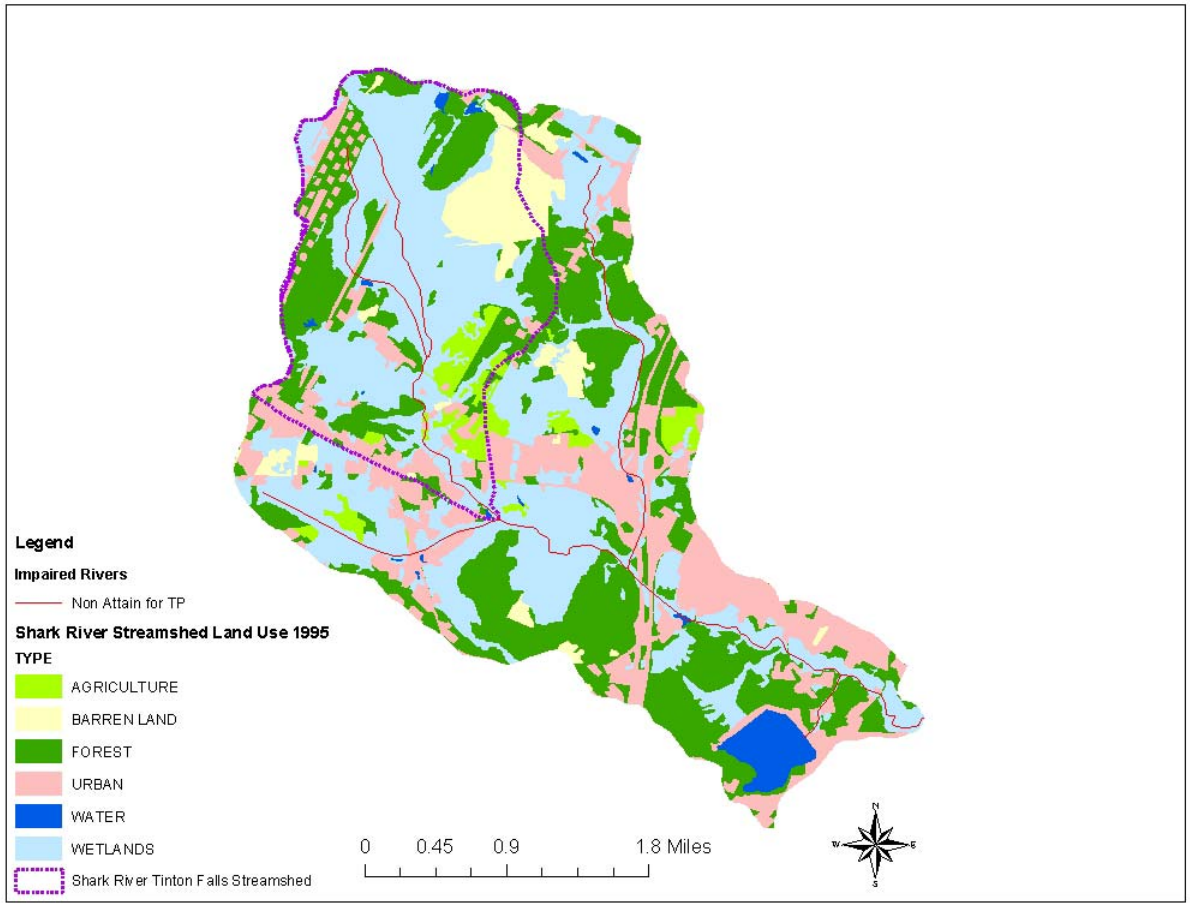
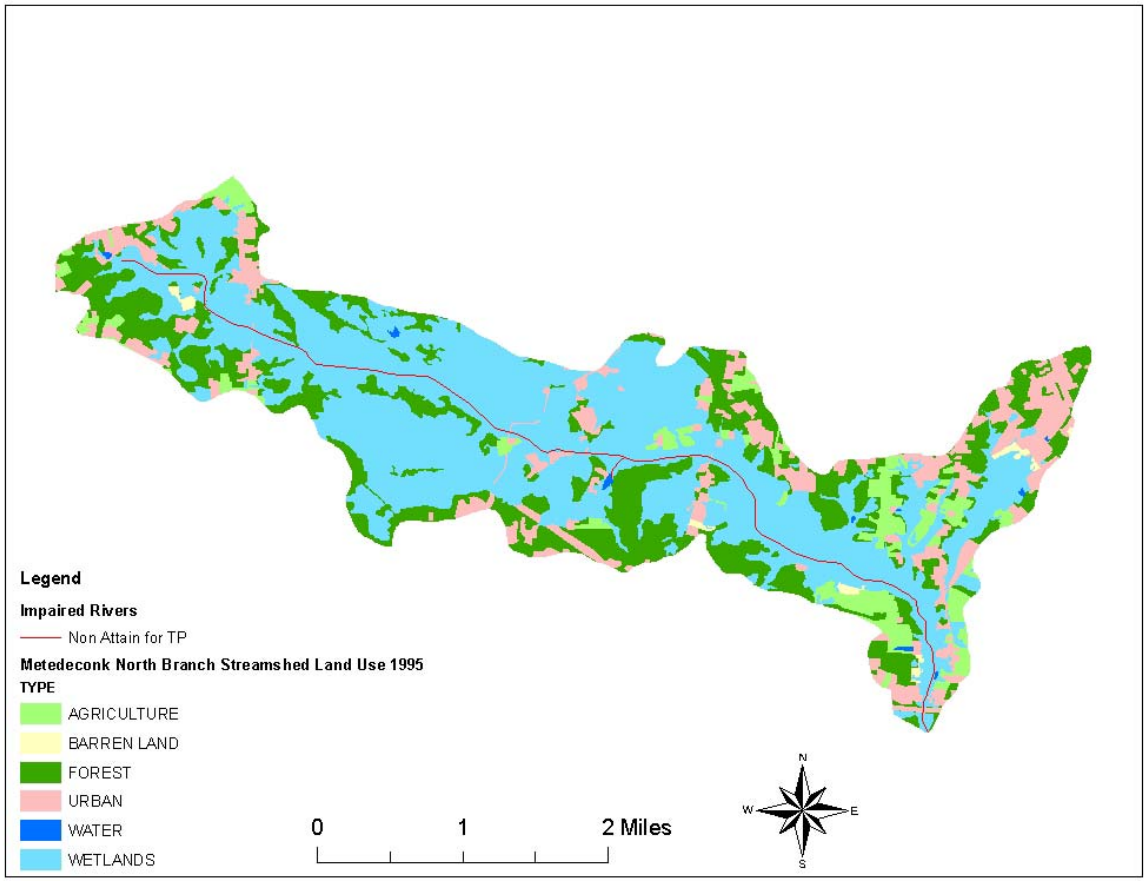
S

# Map of Land Uses for Shark River at Tinton Falls and Shark River at Neptune



# Map of Land Uses for Metedeconk River North Branch at Jackson Mills

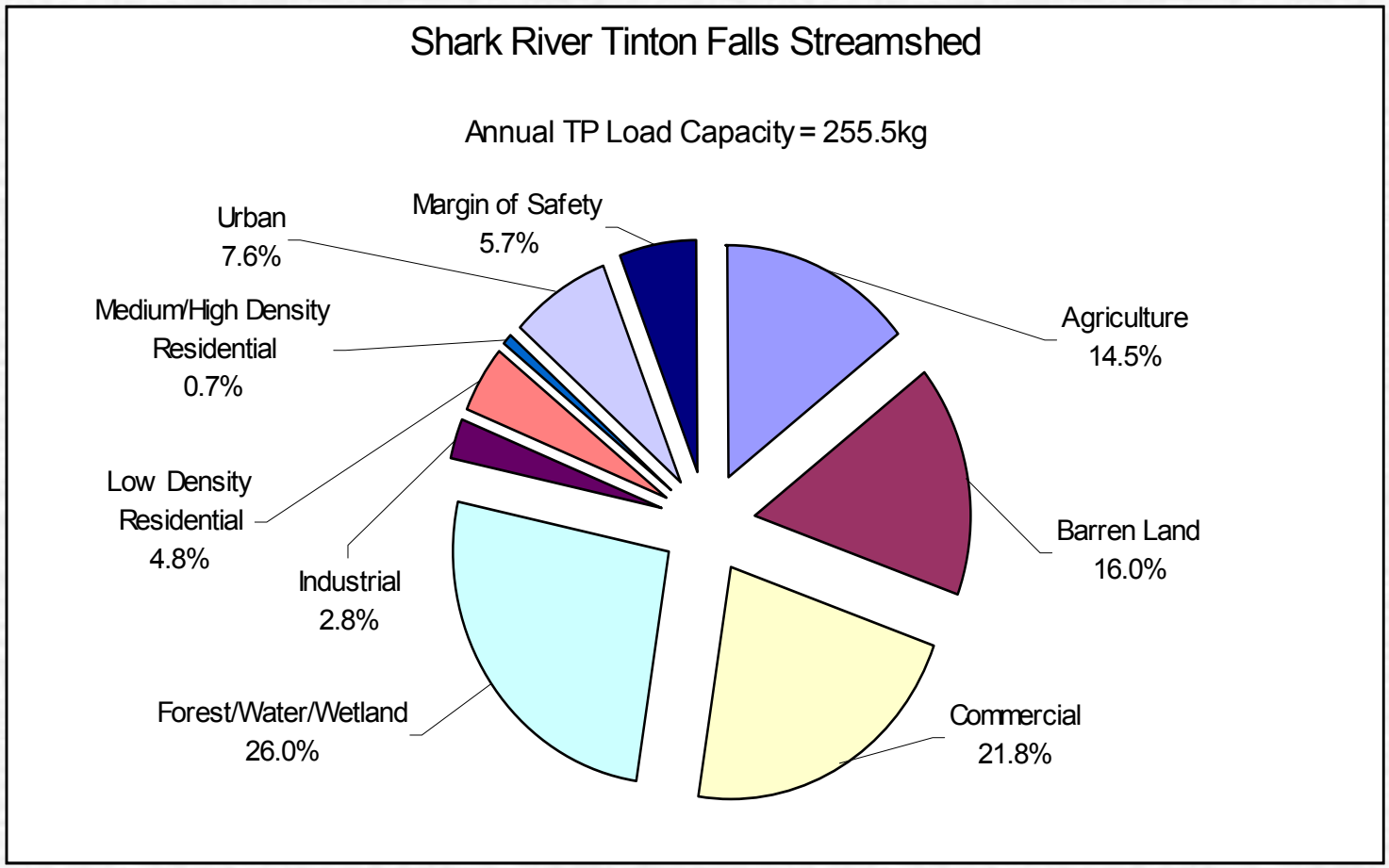


# TMDL Calculations for the Shark River at Tinton Falls

| | Shark River at Tinton Falls | | % reduction |
|---|---|---|---|
| | kg TP/yr | % of LC | |
| **Loading capacity (LC)** | 255.5 | 100% | n/a |
| **LOAD ALLOCATION** | | | |
| **Point Sources other than Stormwater** | n/a | | |
| **Nonpoint and Stormwater Sources** | | | |
| medium / high density residential | 1.8 | 0.7 | 42.8% |
| low density / rural residential | 12.2 | 4.8 | 42.8% |
| commercial | 55.8 | 21.8 | 42.8% |
| industrial | 7.2 | 2.8 | 42.8% |
| mixed urban / other urban | 19.5 | 7.6 | 42.8% |
| agricultural | 37.0 | 14.5 | 42.8% |
| forest, wetland, water | 66.5 | 26.0 | 0% |
| barren land | 40.9 | 16.0 | 0% |
| **Margin of Safety** | 14.7 | 5.7 | n/a |

*Percent reductions shown for individual sources are necessary to achieve overall reductions

# Phosphorus Allocations for the Shark River at Tinton Falls

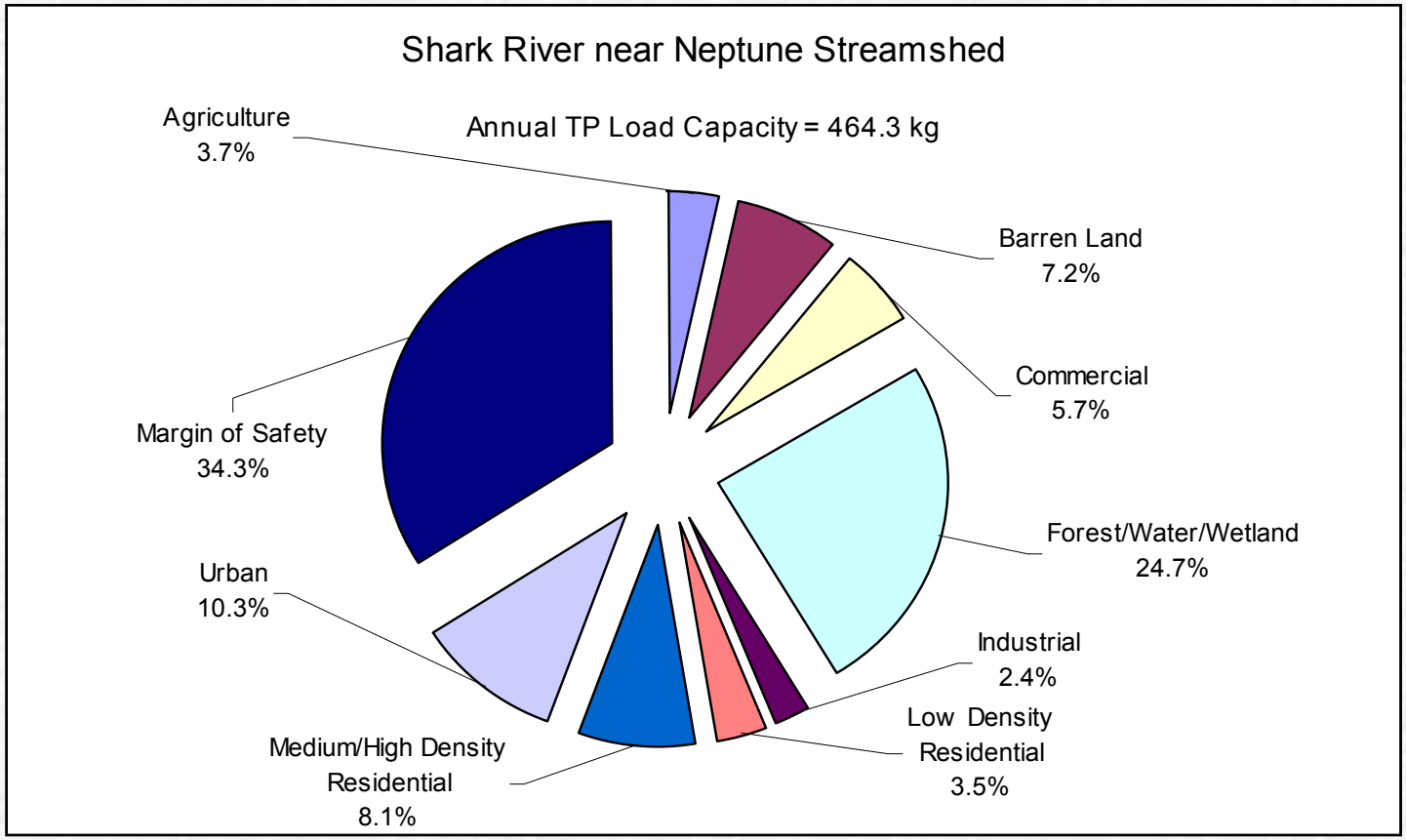


# TMDL Calculations for the Shark River near Neptune

| | Shark River near Neptune | | % reduction |
|---|---|---|---|
| | kg TP/yr | % of LC | |
| **Loading capacity (LC)** | 464.3 | 100% | n/a |
| **LOAD ALLOCATION** | | | |
| **Point Sources other than Stormwater** | n/a | | |
| **Nonpoint and Stormwater Sources** | | | |
| medium / high density residential | 37.6 | 8.1 | 73.7% |
| low density / rural residential | 16.4 | 3.5 | 73.7% |
| commercial | 44.8 | 5.7 | 73.7% |
| industrial | 11.3 | 2.4 | 73.7% |
| mixed urban / other urban | 47.7 | 10.3 | 73.7% |
| agricultural | 17.2 | 3.7 | 73.7% |
| forest, wetland, water | 114.8 | 24.7 | 0% |
| barren land | 33.5 | 7.2 | 0% |
| **Margin of Safety** | 159.2 | 34.3 | n/a |

*Percent reductions shown for individual sources are necessary to achieve overall reductions

# Phosphorus Allocations for the Shark River near Neptune

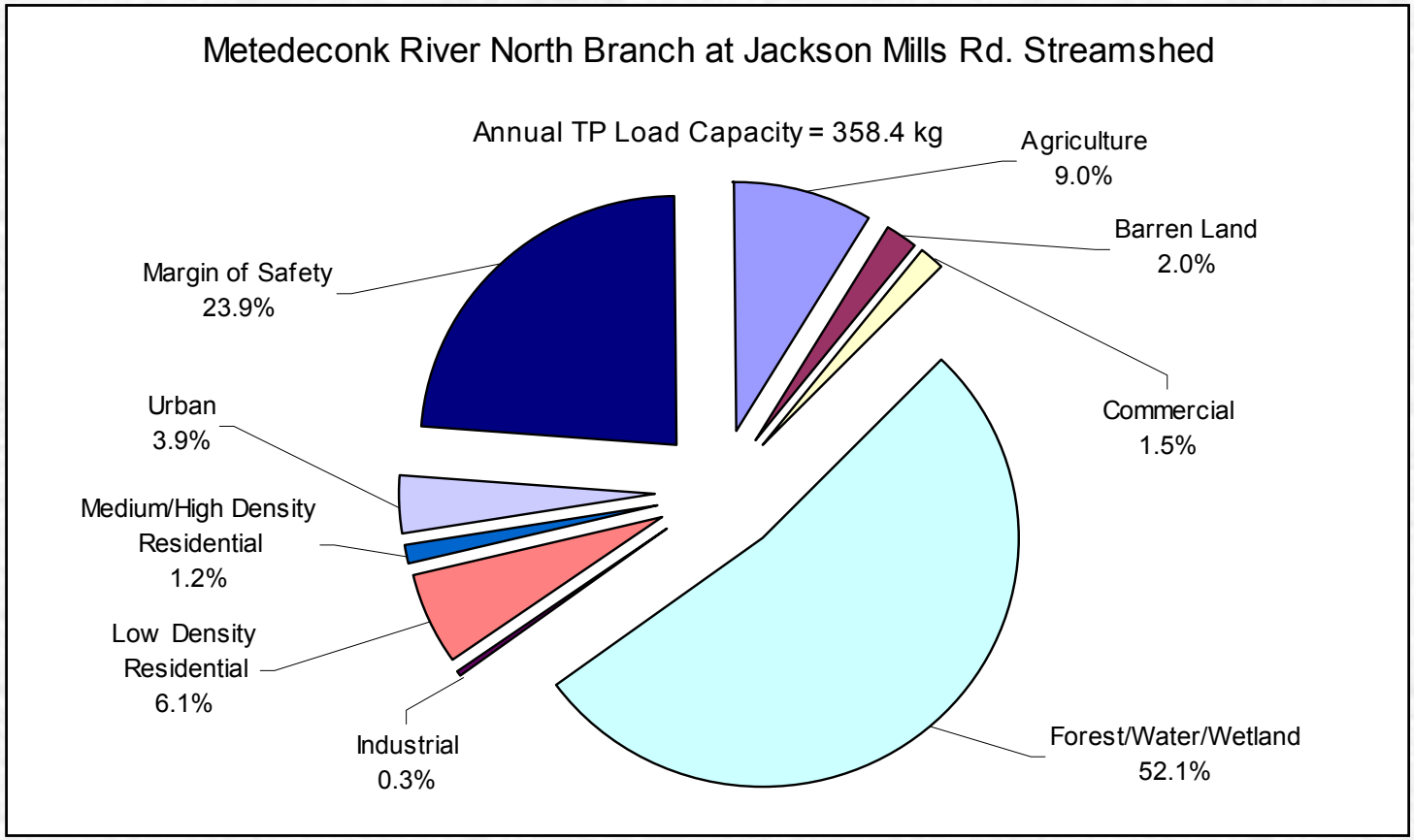


# TMDL Calculations for the Metedconk River North Branch at Jackson Mills

| | Metedeconk R N Br at Jackson Mills Rd. | | % reduction |
|---|---|---|---|
| | kg TP/yr | % of LC | |
| **Loading capacity (LC)** | 358.4 | 100% | n/a |
| **LOAD ALLOCATION** | | | |
| **Point Sources other than Stormwater** | n/a | | |
| **Nonpoint and Stormwater Sources** | | | |
| medium / high density residential | 4.2 | 1.2 | 84.9% |
| low density / rural residential | 21.8 | 6.1 | 84.9% |
| commercial | 5.5 | 1.5 | 84.9% |
| industrial | 1.2 | 0.3 | 84.9% |
| mixed urban / other urban | 13.9 | 3.9 | 84.9% |
| agricultural | 32.1 | 9.0 | 84.9% |
| forest, wetland, water | 186.7 | 52.1 | 0% |
| barren land | 7.2 | 2.0 | 0% |
| **Margin of Safety** | 85.8 | 23.9 | n/a |

*Percent reductions shown for individual sources are necessary to achieve overall reductions

# Phosphorus Allocations for the Metedeconk River North Branch at Jackson Mills



# TMDL Implementation (Point Sources)

- For TMDL purposes, point sources include discharges to surface water that are subject to regulation under the Clean Water Act, National Pollutant Discharge Elimination System.
- Point source reductions are accomplished through NJPDES permits: effluent limits or Phase II stormwater basic requirements, as well as additional measures, if appropriate

# TMDL Implementation (Non-Point Sources)

- For TMDL purposes, nonpoint sources are those that are not subject to regulation under NPDES, including NJPDES Tier B municipal stormwater discharges
- Nonpoint source reductions are achieved through implementation of management measures that can reduce loads, e.g. land use BMPs, NJPDES basic requirements and additional measures applied to Tier B municipal stormwater dischargers, etc.

# Resources for Implementation

- Agricultural BMPs: EQIP, CRP, CREP
- 319(h) grants for nonpoint source projects
- Environmental Infrastructure Financing Program loans
- Estuary Programs
- Private grant programs

# Conclusion

- All TMDL documents are available for download at www.state.nj.us/dep/watershedmgt/tmdl.htm

- Comments are due within 15 days from the date of the public hearing (August 23, 2005) to:

Barbara Hirst, Bureau Chief
NJDEP – DWM
PO Box 418
Trenton, NJ  08625